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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/627,228	07/25/2003	Farhad K. Moghadam	A7632/T49100	2446
57385 7590 09/17/2007 TOWNSEND AND TOWNSEND AND CREW LLP / AMAT TWO EMBARCADERO CENTER EIGHTH FLOOR SAN FRANCISCO, CA 94111-3834			EXAMINER MCDONALD, RODNEY GLENN	
			ART UNIT 1753	PAPER NUMBER
			MAIL DATE 09/17/2007	DELIVERY MODE PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

## Office Action Summary

Application No.

10/627,228

Applicant(s)

MOGHADAM ET AL.

Examiner

Rodney G. McDonald

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 10 July 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-29 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 1-28 is/are allowed.
- 6) ☒ Claim(s) 29 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- ☐ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_.
- ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date: \_\_\_\_\_.
- ☐ Notice of Informal Patent Application
- ☐ Other: \_\_\_\_\_.

## DETAILED ACTION

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claim 29 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chiang et al. (U.S. Pat. 6,428,859) in view of Sherman (U.S. Pat. 6,342,277), Chiang et al. (US PG Pub 2002/0197402) and Machida et al. (U.S. Pat. 4,732,761).

Chiang et al. '859 teach a method of enhanced sequential atomic layer deposition (ALD) suitable for deposition of barrier layers, adhesion layers, seed layers, low dielectric constant (low-k) films, high dielectric constant (high-k) films, and other conductive, semi-conductive and non-conductive films. (See Abstract) The method comprises exposing the substrate to a first gaseous reactant allowing a monolayer of

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the reactant to form on the surface. The monolayer is adsorbed onto the substrate.

(Column 8 lines 25-27; Column 12 lines 56-58) The reactant is evacuated from the

chamber. (Column 8 lines 33-35; Column 12 lines 59-60) The monolayer is exposed to radicals while biasing the substrate to react with the monolayer to deposit the thin film.

(Column 8 lines 36-56; Column 12 lines 65-68; Column 13 lines 1-6) The process is repeated until the desired film thickness is built up. (Column 8 lines 60-61)

Chiang et al. '859 teach that the reactants are adsorbed. (Column 5 lines 62-65)

The differences between Chiang et al. '859 and the present claims is that the first reactant and the second reactant is not discussed, where the level of the applied bias is sufficient to cause sputtering is not discussed, forming the film over a substrate having a gap between two adjacent raised features is not discussed and the sputtering effect causing the silica film to grow up from the bottom surface of the gap at a rate greater than it grows inward on the sidewall surface of the gap is not discussed.

Regarding the first reactant and the second reactant, Sherman teaches a process for growing a thin film including a plurality of cycles, wherein at least one cycle comprises exposing a part to a gaseous first reactant, including an element of the thin film to be formed, wherein at least a portion of the first reactant adsorbs on the part; purging the chamber of the gaseous first reactant; converting the portion of the first reactant adsorbed on the part to either an element or compound by exposing the part to a gaseous second react that includes radicals created by a plasma discharge, whereby a thin film is formed; and purging the chamber of the gaseous second reactant.

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(Column 12 lines 54-64) The first and second reactants for forming silica glass are silane and oxygen. (Column 8 lines 38-51)

Regarding where the level of the applied bias is sufficient to cause sputtering, Chiang et al. '859 discussed above teach applying a bias of -20V to -500 V during radical exposure. The Examiner asserts that the higher end of the range causing sputtering. Chiang et al. '859 teach that oxygen and/or radicals can effect etching. (Chiang et al. '859 Column 12 lines 33-52) Furthermore, Chiang et al. '402 recognize that values over  $|-150V|$  will cause sputtering. (See Paragraph 0046) Furthermore, Machida et al. recognize that in a second step of CVD that a bias voltage should be applied to cause sputtering to fill openings in a substrate. (See Abstract; Column 9 lines 4-7, lines 11-21, lines 30-45)

Regarding forming the film over a substrate having a gap between two adjacent raised features, Sherman teach filling a gap having two adjacent raised features. (Column 11 lines 42-46)

The motivation for utilizing the elements of Sherman is that it allows for depositing a conformal layer of uniform thickness. (Column 5 lines 22-24)

Regarding the sputtering effect causing the silica film to grow up from the bottom surface of the gap at a rate greater than it grows inward on the sidewall surface of the gap (Claim 29), Machida et al. teach growing a silica film at a rate greater from the bottom than of the sidewalls. (Column 9 lines 3-10)

The motivation for utilizing the features of Machida et al. is that it allows for planarization. (See abstract)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified Chiang et al. '859 as taught by utilizing the elements of Sherman and the particular bias as taught by Chiang et al. '859 further evidenced by Chiang et al. '402 and Machida et al. because it allows for depositing a conformal layer of uniform thickness.

***Allowable Subject Matter***

Claims 1-28 are allowed.

The following is a statement of reasons for the indication of allowable subject matter:

Claims 1-14 are allowable over the prior art of record because the prior art of record does not teach the claimed subject matter including converting the silicon-containing reactant into a silica glass insulating compound using primarily thermal energy to provide activation energy to drive the deposition reaction by exposing the substrate to oxygen radicals formed from a second reactant while biasing the substrate to promote a sputtering effect.

Claims 15-28 are allowable over the prior art of record because the prior art of record does not teach the claimed subject matter including converting the silicon-containing reactant into a silica glass insulating compound by exposing the substrate to a plasma formed from a second reactant comprising oxygen atoms while biasing the substrate to promote a sputtering effect, wherein an average atomic mass of all atomic constituents introduced into the chamber during the converting step is less than or equal to an average atomic mass of oxygen and wherein the substrate is maintained at a

temperature between 300-800°C during growth of the silica glass film and wherein the silica glass film grows up from the bottom surface of the gap at a rate greater than it grows inward on the sidewall surface of the gap.

***Response to Arguments***

Applicant's arguments filed July 10, 2007 have been fully considered.

All claims have been indicated as allowable except for claim 29. Claim 29 will now be addressed.

Applicants first state that they are unsure as to how the Office Action is using Chiang with respect to claim 29. Applicants then argues that it is unclear how Machida can be combined with Chiang and Sherman since they do not involve the same processes. Applicant then argues that Machida is nonanalogous art to that of Chiang and Sherman.

In response to the argument that is unclear how Chiang is utilized, the Examiner urges that Chiang '859 teaches a method of depositing silica glass insulating film on a substrate. Exposing the substrate to a silicon-containing reactant introduced into a chamber in which the substrate is disposed such that one or more layers of the silicon reactant are adsorbed onto the substrate. Chiang '859 teach evacuating the chamber of the silicon-containing reactant. Chiang '859 teach converting the silicon-containing reactant into silica glass insulating compound by exposing the substrate to radicals while biasing the substrate to promote a sputtering effect. The steps can be repeated. (See Chiang '859 discussed above) Sherman teach that oxygen can be used as the second reactant to form the silica insulating film. (See Sherman discussed above)

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Machida show that silica can fill a gap between two adjacent raised surfaces. The silica is filled from the bottom up. (See Machida discussed above)

In response to the argument that Machida can not be combined with Chiang and Sherman because they utilize different processes, it is argued that since both processes utilize vapor reaction chemistry to produce the layers that the references can be combined since the processes are similar. The claims further are not limited to depositing atomic layers. (See Machida, Chiang and Sherman discussed above)

In response to applicant's argument that Machida is nonanalogous art, it has been held that a prior art reference must either be in the field of applicant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the applicant was concerned, in order to be relied upon as a basis for rejection of the claimed invention. See *In re Oetiker*, 977 F.2d 1443, 24 USPQ2d 1443 (Fed. Cir. 1992). In this case, Machida is in the field of applicant's endeavor (i.e. depositing thin films through vapor phase reaction chemistry).

### ***Conclusion***

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any

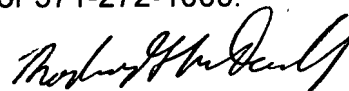


extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rodney G. McDonald whose telephone number is 571-272-1340. The examiner can normally be reached on M-TH with every Friday off..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam X. Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

  
Rodney G. McDonald  
Primary Examiner  
Art Unit 1753

RM  
September 12, 2007